

Flipped learning: comparing the student experience from 1st year to postgraduate

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INTRODUCTION

While flipped instruction may be the standard practice in many social science programs it is often promoted as a recent innovation in learning design within science and technology classrooms. Flipped instruction is a form of blended learning that replaces transmission-based lectures with more participative, interactive and collaborative learning opportunities. Activities are typically undertaken before, during and after class, freeing in class time to participate in activities that often engage concepts at a higher level. Flipped activities typically require students to undertake out of class preparatory work, engage in in-class dialogue and collaborative learning and we suggest be more independent in their approach to learning.

Typically instructors focus on their students' cognitive development in relation to the subject material. However, students' expectations of how a subject can be delivered and their level of metacognitive skill development will also affect how they engage with the content of a subject and hence impact on their learning. Our investigation is concerned with how these factors impact students' response to flipped instruction.

This paper reports the exploratory phase of an ongoing study investigating the impact of flipped instruction on first year, third year and postgraduate students. We found that most students irrespective of their stage of study preferred flipped instruction compared to the more traditional lecture style approach agreeing that it had a positive impact on their learning experience. There was also evidence that the different learning expectations and focus of the undergraduate students in particular those in first-year meant that many may not be ready for the responsibility and independence demanded to engage with flipped instruction without scaffolding and support.

1 BACKGROUND

Flipping should not simply be about changing the method of content transmission but rather as an opportunity to significantly improve student development. We suggest that flipped instruction requires students to take more responsibility for their own learning. This often requires students to change their approach, regularity, attitude and culture through which they engage in their learning. The

increased responsibility for and independence of their learning requires them to exercise metacognitive skills such as self-management (self-evaluation and self-regulation) and also depends on their self-efficacy. Self-efficacy, the belief in one's capacity to organise and carry out the actions required to achieve one's objectives [1], is an important factor in determining how a student engages with the learning opportunities provided. Unless a student believes they have the capacity, including understanding, judgement or skills, to learn from flipped activities they are unlikely to have the incentive to engage and/or persevere when difficulties are encountered [2].

We suggest that the more mature the students the better their self-management, the higher their self-efficacy, the wider their experiences of learning and hence the greater their capacity to make the most of the opportunities afforded by flipped instruction.

Studies in transition pedagogy [3 – 5] illustrate the gap in expectations between first year students and instructors in relation to the amount of study (outside of class time) students should be undertaking when enrolled at university. Recent school leavers entering university also felt that school had not adequately prepared them for university study [5].

Hence given the different experience of students, both within a particular cohort and between cohorts at different stages of their degree, we need to provide scaffolding to assist students to understand how to make the most of these learning opportunities, including how to approach them, evaluate their learning, develop their judgement and the required learning skills.

At the very least an instructor should use scaffolding to create a learning-focussed environment motivating students to undertake activities with a focus on learning. In developing scaffolding we recommend that instructors not just explain what students need to do for an assessment activity, but what the students are expected to learn from undertaking the activity, how they can assess for themselves how much they have learnt in the process, and finally how that learning outcome contributes to their professional expertise and enables them to view the world differently. In addition we recommend students need regular opportunities to not only evaluate their learning but to appreciate how much they have learnt. This can be achieved by facilitating comparison of early understandings to those achieved later in the semester. For example through pre-and post-activity formative assessments or describing what students will be able to do and subsequently demonstrating how each activity has contributed to the overall learning objective.

1.1 Motivation for this study

The motivation for this research is to investigate the impact of flipped instruction on students at different stages in their learning journey. We theorise that first-year students may be less prepared and not necessarily have the skills to make the most of their flipped instruction experience compared to later stage undergraduate and postgraduate students.

2 METHOD

In this paper we investigate the experience of first year, third year and postgraduate students undertaking flipped instruction, most for the first time. Our study focuses on investigating the impact of flipped instruction on students' learning experience. In particular we explore their expectation of flipped instruction, their preparedness to undertake it and its potential to develop students' learning independence. Student interactions were captured through academics observing students undertaking the in-class activities paying particular attention to their level of preparation, interaction and approach. In addition, students were asked to volunteer to complete an online survey consisting of a number of Likert scale multiple-choice and free response questions. While not conducted at the time of writing this paper, the final stage of this study will consist of focus group discussions with students from each cohort. Details of the three subjects used in this study are shown below:

Engineering Mechanics (1st-year) is a compulsory subject for students studying in the Civil Engineering or Civil and Environmental Engineering programs. The subject addresses the concepts typically included in a first year mechanics course. The second author has been teaching this subject for many years and in the Autumn 2014 semester there were 111 students enrolled. Students were expected to engage with the content each week by reading the relevant sections of the specified textbook, watching short videos and answering a set of online questions before the nominal lecture session. After the lecture session they were expected to attempt tutorial questions before attending a face to face tutorial session. Each week two types of videos were posted. The first type covered the

week's content and the second type showed the instructor's process in solving example questions in a 'think aloud' way [6]. During the nominal lecture session students worked collaboratively to explore and solve problems chosen to illustrate particular aspects of the week's concept, or completed formative assessment tasks aimed at allowing them to determine what they didn't yet know at the required standard.

Continuous Communications (stage 6 of 8) is a Telecommunications subject within the Information and Communication Technologies (ICT) Engineering degree at the University of Technology, Sydney (UTS). In autumn semester 2014 the first author taught this subject for the second time. The subject content was delivered through a combination of a series of short videos (21 in total, approximately 5 minutes in length, 15 specific content, 6 in the form of online demonstrations, made on the instructor's PC using inexpensive software and a document camera), notes, inquiry based learning activities and a series of formative individual and collaborative assessments. The videos intentionally did not cover all the content but rather targeted the more difficult and/or threshold concepts within the subject. The subject outline clearly identified the required learning outcomes and competency objectives of the subject. In addition, students were expected to consult one or more of the many textbooks available on the subject material.

The weekly format combined out of class readings, formative individual assessments, inquiry-based learning activities and online video presentations, with in-class formative collaborative assessments and /or learning activities.

The in-class activities were designed as opportunities to engage with the subject material at a higher level as opposed to introducing additional content or an opportunity to do tutorial work.

The class was small, having only 21 students, although senior undergraduate students, all were undertaking flipped instruction for the first time.

Communications Protocols (postgraduate) This subject is an introductory compulsory unit in the Master of Engineering Studies with major in Telecommunication Networks. It was previously taught by the third author for over 10 years through a combination of 14 hours of face to face lectures, 7 hours of tutorials and around 11 hours of laboratory work. In the August session of 2013, the subject was delivered with no face to face lectures, 10 hours of tutorials and 14 hours of laboratory work. This represents a 30% reduction in teacher face-to-face time. The assessment in the subject was unchanged.

A total of 34 recorded video lectures were made available to students online with a total length of around 9 hours. The average length of the videos was around 15 minutes. These were recorded using Camtasia Studio software (A\$185) running on a laptop with an external USB microphone. Videos consisted of a powerpoint slide show, alternating with a (A\$99) document camera for solving problems using a pen and paper as well as audio.

Tutorials focused on preparing students for quizzes and laboratory work (i.e., the assessment tasks) as well as debriefing after these assessment tasks. Students were emailed about 2 weeks before the first tutorial and asked to watch the lecture videos. They were told not to bother coming to the tutorials if they had not watched the videos beforehand.

3 RESULTS AND DISCUSSION

In all three subjects used in this study students were expected to undertake out of class preparation including a combination of readings, watching videos, individual quizzes and enquiry based laboratory preparation. Depending on the subject the in-class participative activities included collaborative multiple attempt quizzes, enquiry based discovery activities, tutorial problem solving and discussions, laboratories and demonstrations.

12 of 111 students in the first year subject Engineering Mechanics, 10 of 21 students in the third year subject Continuous Communications and 6 of 31 students in the postgraduate subject Communications Protocol volunteered to complete the survey. The numerical results for the survey questions relevant to this study are shown in Table 1: Student Expectations and Table 2: Self-management and Self-efficacy perceptions. In the following discussion we will explore students' explanation of their experience.

The vast majority of participants agree that they liked the flipped instruction approach more than the traditional lecture style. Their reason for liking flipped instruction mostly related to the perception that it freed up class time for more participative learning activities and that it supported a more flexible learning approach.

"it encourages students to be organised and pro-active with learning, plus provides an opportunity to have questions answered during the learning process, as opposed to it happening at a later stage" (1st year).

The classes *"focused on what I didn't understand as opposed to pushing out volumes of information. At home I could work out what I needed help with and in class that was addressed"*. (3rd year)

"I found it helpful doing the collaborative exercises with other students - I think everyone is more likely to ask questions (not as embarrassing as asking the lecturer during his lecture) and you learn a lot from being able to explain something to others and vice versa". (3rd year)

"it allowed me to complete lectures whenever I pleased or even in parts if need be (ie break it into hour slots). It also allowed me to pause lectures to complete note taking during the lecture." (Postgraduate)

When asked about the impact of flipped instruction on their learning experience most students agreed that it was positive (80% first year, 90% third year, 100% postgraduate). Their reasons mainly focused on that it prompted them to work more consistently, provided ongoing evaluation of their learning, provided opportunities to receive help in class and the flexibility to engage with material in their own time.

"...because it forces - or at least attempts to force - me to be more organised, and therefore fall less behind than I otherwise might have". (1st year).

"It allowed me to identify what I need help with and knowing that I can get that specific help in class has been a positive thing". (3rd year)

"...for me Flipped instruction is new and it has had a positive impact on my learning experience". It "allowed me to have all resources related to the subject any time anywhere, which is great" (Postgraduate).

Not surprisingly the highest percentage of students of the three stages that stated a preference for the more traditional lecture style were in the first year subject (30%), (10% third year and 17% postgraduate). Their reasons included:

- **wanting direct instruction**

"I think that the flipped instruction model is not as preferable as the traditional approach. I believe online videos are a fantastic idea for revision purposes and are extremely helpful when going over already covered material. I do not however believe they should entirely replace the approach of introducing new material in the live lectures, but should serve as additional resources" (1st year).

- **associated stress and motivation for formative activities**

"It created stress, with the deadlines of other subject's assessments approaching, my priorities were securing marks in those subjects, rather than preparing for class with no marks attached. In the early weeks of the semester it was a lot easier to maintain a good preparation for class then it was later on with the realities of full time study and numerous deadlines" (1st year).

"It's made me more anxious that I'm on my own on quite a challenging subject" (3rd year student).

Flipped learning takes *"more time to study the subject material but students not only study 1 subject, so quite a lot of pressure"*. (3rd year)

Students were also asked about their learning expectations, in particular, if it was reasonable to expect them to find their own supplementary resources, to prepare out of class for in-class activities and engage with material out of class that had not yet been discussed in class.

In general the third year and postgraduate students overwhelmingly agreed that it was reasonable to expect them to engage with material out of class that has not yet been discussed in class if resources such as online videos are provided. Typical comments included:

"I like to know lecture content beforehand so I can have some understanding of what will be taught - having access to online videos is an easy way to get an introduction to new material. Personally I don't find traditional lectures very effective, so watching the videos and then being able to work on problems in class is definitely better for real learning" (3rd year).

"From my point of view and I think that is reasonable to expect students to engage with material out of class in that way push the pupils to be more autodidact " (Postgraduate).

While 30% of the first year students thought it was unreasonable to expect students to engage with material out of class that had not yet been covered in class. One of these students commented that:

"it's unreasonable for the live lectures to assume a coherent understanding of the new week's material, without any form of summary of the week's material presented first. Students cover the material at different times during the week, and it is often not possible for a student to allocate sufficient time to watching the videos prior to attending class. At the very least, I think at least 30minutes to an hour of the 3 hour lecture would be better spent going over the online material in a summary form. This accommodates for students who may not have had time to view the videos for that particular week, while also solidifying the understanding of those students who did prepare".

Table 1: Student Expectations

	Engineering Mechanics n = 12 out of 115		Continuous Communications n = 10 out of 21		Communications Protocols n = 6 out of 31	
	Disagree	Agree	Disagree	Agree	Disagree	Agree
I think it's reasonable to expect students to engage with material out of class that has not yet been discussed in class if resources such as online videos are provided.	30%	70%	0%	100%	17%	83%
I think it's reasonable to expect students to find their own resources in addition to those provided by the instructor to support their learning.	60%	40%	40%	60%	0%	100%
I think it's reasonable to expect students to prepare before class for in-class learning activities.	20%	80%	10%	90%	0%	100%

While all the postgraduate participants agreed that it was reasonable for them to find their own resources to supplement those provided by the instructor, the undergraduate students were fairly evenly split between agreement and disagreement. Even for those that agreed many reported that they didn't take the opportunity to do so as in their experience in most classes the provided resources were sufficient for them to achieve their desired grade.

"I think this is reasonable, although to be honest I don't think many students (myself included) take this very seriously. Most subjects at uni provide you with access to all the required material you need to pass the course" (3rd year).

A number of students reported that they lacked the confidence to exercise their judgement in deciding the quality and appropriateness of the resources they had to source themselves. Indicating that *"there is so much online, it's hard to sort through it all"* (3rd year).

The first-year students 60% of whom felt it was not reasonable to expect them to find their own resources, were mainly concerned about time management or felt that the development of the skills necessary to find one's own resources should be left to a later stage of the course.

"I think that 95% of learning resources should be taught/ provided in depth, so no time is wasted learning something outside of the course unknowingly with no relevance to the subject" (1st year)..

"finding resources can be very time consuming. When I finally find what I want, or work out what I need to work out, I often wonder if that outcome could have been achieved in a lot less time. Sure, I might have picked up certain other things along the way, but if the essential content and resources were made available in a more concentrated/focussed/condensed form, I believe it possibly may prevent a lot time from being unnecessarily wasted" (1st year).

“At this point in a student's degree I think a coherent and comprehensive understanding of the syllabus should be the priority, with as many resources available to students as possible” (1st year).

However, most students agreed that it was reasonable to expect students to prepare before class to allow time to undertake in-class learning activities. Their reasons included:

“This is only a positive thing for students”. As it “frees up time for topics that are unclear to be covered in class, as opposed to material everyone may be up to speed with” (3rd year).

“Having the weekly quizzes was great, I knew straight away where I needed to learn (most of the time everything..) and by doing out of class preparation I was more engaged in the lecture/tutorial time. Again, it's just one of those cultural things with uni that will take some time to change - most of us are too lazy and are used to trying to absorb the weekly information in a 2/3 hour lecture block” (3rd year).

“I am totally agree about it, in that way the class become more interactive (in two ways). A class where students are active part of the lesson and will have an overall idea about what the lesson is about” (Postgraduate).

In regard to motivation there was a noticeable difference between the undergraduate students and the postgraduate students. A small but significant portion of the undergraduate students reported a focus on gaining marks rather than learning, especially from the formative activities:

“...my priorities were securing marks in other subjects, rather than preparing for class with no marks attached” (1st year student).

“I think I would have tried a lot harder to complete the quizzes and learn the material well if they were worth marks; even just one mark per quiz would have added up to a somewhat significant portion of the course. I think that would greatly improve participation rates as well” (3rd year student).

I think most students will not do it (out of class preparation) because there are no marks involved. There's little motivation” (3rd year student).

Interestingly the in-class learning activities of the two undergraduate classes reported in this study were formative whereas in the postgraduate subject the in-class activities were regularly summative. Hence, this may have been the reason why it wasn't mentioned by postgraduate students rather than the fact that they appeared to be more motivated to learn. What we can say is that this lack of motivation in some students prevented them from engaging at the expected level with the learning opportunities provided. Peers who were in group activities with these students reported that they were participants asking questions to keep up rather than contributing to the group activity.

Table 2: Self-management and self-efficacy perceptions

	Engineering Mechanics n = 12 out of 115		Continuous Communications n = 10 out of 21		Communications Protocols n = 6 out of 31	
	Disagree	Agree	Disagree	Agree	Disagree	Agree
Compared to the more traditional lecture approach flipped instruction has made me feel I am more responsible for my own learning.	20%	80%	0%	100%	17%	83%
Flipped instruction has required me to better manage my study time	30%	70%	20%	80%	50%	50%
Having to undertake flipped instruction has made me more confident that I can learn on my own.	50%	50%	20%	80%	33%	67%

We also investigated the impact of flipped instruction on students learning responsibility and study planning. Students from all three cohorts reported that compared to the more traditional lecture approach flipped instruction had made them take more responsibility for their own learning. Typical comments included:

“Since this model (flipped instruction) has made it easier to fall behind, yes, a much greater responsibility exists for individual learning” (1st year student).

"because you know you will get the most out of the content if you study it before class. The approach forces you to be more organised as well"(1st year student).

"the onus is on yourself to make progress with your understanding" (3rd year student).

"I've felt I've had to do a lot of independent reading and learning" (3rd year student).

"If I did not prepare class or lab myself beforehand, I would be lost. It is my responsibility to be ready for class because no one would do it for me" (Postgraduate).

However one first-year student reported that passing more responsibility on to students for their own learning made them *"feel like the uni is being lazy"*.

Students from all three cohorts also reported that compared to the more traditional lecture approach flipped instruction had required them to better manage their study time:

"It becomes a lot easier to fall behind with this model, as one week of missed online videos completely alienates a student in the live lecture"(1st year student).

"I worked more regularly, but still have left studying to the last minute. But, this subject out of my current 5 has been the one I've been most motivated to learn" (3rd year student).

"Managing my time is one of my strong traits. I prioritize my tasks and this allows me to stay ahead of schedule. Each day I manage my time so I can achieve more than I set out to do. So managing my time in a goal oriented way is what I feel very comfortable doing" (Postgraduate).

4 FINDINGS / RECOMMENDATIONS

Students from all different stages of their learning journey overwhelmingly reported they liked flipped instruction and the more interactive learning opportunities it provides. Most believe that it had a positive impact on their learning experience promoting a transition to more independent and responsible learners. However the study showed that many undergraduate students while happy to undertake out of class preparation were less motivated and confident in their judgement and capacity to source their own supplementary resources or independently study material not yet covered in class compared to their postgraduate counterparts. The attitude of the first year students is understandable since for most of them their dominant learning experience has been the school model. That third year students have many of the same attitudes suggests that their university program may have not provided sufficient learning experiences that challenged and/or altered this thinking. The perceptions of the postgraduate students are not surprising given that most of them were working full time. The fact that they'd already completed an undergraduate degree, their work experience and associated professional development that comes through practice equips them to readily adapt to the flipped instruction environment. In fact many of the postgraduate students preferred it, in particular for the study and learning flexibility it provides. We also find that students require supporting scaffolding to assist them to develop the skills and attitudes required to make the most of flipped instruction learning opportunities. Ideally students would experience such scaffolding in all subjects with the focus and design changing with student needs as they develop. The scaffolding should promote changes in students learning culture, develop language to enable them to describe and discuss their learning and develop maturity in the way they think about, characterise and evaluate their learning (for example grades are not always an accurate indication of learning achievement).

In contrast to the postgraduates a number of undergraduate students reported that their motivation for engaging with the formative flipped activities would have been far greater if they'd contributed to their overall grade. There is always a temptation to include marks for motivation. Indeed this approach was taken in the postgraduate subject used in this study. It is not the preference of two of the authors. While students may need more active scaffolding to get them to engage in formative activities, they encourage a focus on learning by providing an opportunity for students to practise and get it 'wrong' in a safe environment without penalty. We suggest explaining and demonstrating to students how to use formative activities to identify their learning gaps and then have them addressed by their peers and the instructor within the in-class activities flipped learning facilitates. To this end we have found that providing regular opportunities for students to not only evaluate their learning but to appreciate how much they have learnt (for example, by providing opportunities to compare early understandings to those achieved later in the semester) can provide both a sense of achievement and promote learning motivation.

This exploratory study has generated at least as many questions as it answered and so will inform the design of our further studies of flipped learning.

5 CONCLUSIONS

Flipped learning should be seen as an opportunity to free up class time to allow participative learning opportunities not merely as a means of changing information transmission from face-to-face to online. We find that although it has significant potential to improve learning outcomes, it does require commitment, at least initially, of additional time, resources and skill development on the part of academics and a change in learning culture for many students. Supporting scaffolding should be used to assist students to develop the skills and attitudes required to make the most of flipped instruction.

The results of this exploratory study indicate that students from all stages of their learning journey overwhelmingly reported liking flipped instruction compared to the more traditional lecture style delivery format. Most students believe that it had a positive impact on their learning experience and promoted them to become more independent and responsible learners. However many undergraduate students while happy to undertake out of class preparation were less motivated and confident in their judgement and capacity to source their own supplementary resources or independently study material not yet covered in class compared to their postgraduate counterparts. We recommend that students are provided with supporting scaffolding to assist them to develop the skills and attitudes required to make the most of the learning opportunities flipped instruction provides.

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